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Managing innovation networks: Exploratory evidence from ICT, biotechnology and nanotechnology networks

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ABSTRACT

This study examines the management of innovation networks which has enjoyed increased recognition in the marketing literature due to its growing prominence and relevance. By testing a causal model relating network factors to outcomes, the study contributes to theory development on managing innovation at the net level of analysis. Consequently, it contributes to the respective marketing literatures on new product development, open innovation, industrial marketing and its emerging network management sub-stream. It also offers a methodological contribution as respondents include key players from businesses, government agencies, research organizations and universities rather than from only one focal organization as studies in extant literature have predominantly done. Findings are based on 219 responses from Australian high technology networks, namely, information and communications technology and biotechnology/nanotechnology. The study offers valuable implications for marketing managers involved in new product development and innovation concerning strategies for managing their inter-organizational innovation initiatives effectively.

1. Introduction

This study builds on several marketing streams which stress the importance of networks for innovation success. The new product development (NPD) literature has traditionally focused on the firm (Moorman, 1995; Moorman & Slotegraaf, 1999). More recently, it has acknowledged the importance of inter-firm cooperation (Rindfleisch & Moorman, 2003; Sivadas & Dwyer, 2000; Wuyts, Dutta, & Stremersch, 2004). The open innovation literature also advocates the importance of external agents for innovation (Chesborough, 2003; Laursen & Salter, 2006). Additionally, the business-to-business (B2B)/industrial marketing literature underlines the fundamental role of networks in fostering innovation (Hakansson, 1982). In particular, Moller and Svahn (2009) have called for further research examining the management processes in innovation networks as these networks have grown in relevance due to the impact of science and technology fields and the variety of players involved (Geels, 2002). They argue that while there is research on the characteristics of emergent business fields and existing networks, particularly supply chain networks, there is little research on management processes in the context of emerging innovation networks, an area that would be highly relevant to managers (Moller & Svahn, 2009).

The study contributes to these literatures by providing a network level perspective that incorporates the views of diverse network participants rather than remaining limited to the firm perspective. Firms are increasingly innovating within networks rather than through in-house R&D for a number of reasons. These include changes towards more complex R&D initiatives, increased development times and costs, decreased product life cycles, rapid globalization and competition for limited scientific expertise (Tushman, 2004). Innovation networks comprise businesses, research organizations, universities and government working together to achieve shared innovation goals. Many countries have recognized the importance of these networks in developing innovation capacity, international competitiveness and wealth creation. In fact, in countries such as the United States, Australia and the United Kingdom, innovation policies have shifted R&D funding and incentives towards encouraging multi-sectoral innovation networks (Corley, Boardman, & Bozeman, 2006).

The pervasiveness of enabling technologies has also propelled innovation networks to increased prominence. These technologies include nanotechnology, biotechnology and information and communications technology (ICT). They are used in a wide variety of industries, and have, therefore, contributed to blurring organizational boundaries among research organizations resulting in dense and large networks (Powell, Koput & Smith-Doerr, 1996; Roijakkers & Hagedoorn, 2006). For instance, both biotechnology and nanotechnology have had a tremendous influence as scientific organizations have shared expertise

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and resources due to large investments in infrastructure, leading to networks spanning these two fields (Robinson, Rip, & Mangematin, 2007). Therefore, the extensive reach of these technologies across diverse sectors has inevitably led to the widespread permeation of innovation networks.

Extant literature has mainly focused on private sector organizations and has ignored the views of those incorporating the public sector (Plewa & Quester, 2006). Furthermore, it has focused on existing business networks especially supply chain networks rather than emerging innovation networks (Moller & Svahn, 2009). Additionally, it has predominantly provided an organizational perspective while ignoring collective network level views of the wider range of network participants (Provan & Milward, 1995). Network-based research would be of interest to marketing managers involved in NPD and innovation as it would offer rich insights on engaging effectively in collaborative innovation with universities and research institutions, preparing and managing collaborative work funded by public grants, and participating effectively in innovation clusters and public–private innovation initiatives.

This study aims to address the gap in extant literature and to respond to calls for research on the management processes in innovation networks (Moller & Svahn, 2009) by investigating the key factors leading to the effective management of innovation networks from the perspectives of diverse network actors, including businesses, universities, research organizations and government agencies. To achieve this aim, the paper first reviews the literatures on B2B/industrial marketing, and in particular, its emerging network management sub-stream along with the related marketing literature, including NPD and open innovation. Our hypotheses and methodology are then presented. Findings are subsequently discussed by highlighting similarities and differences between the Australian ICT and biotechnology/nanotechnology networks which are used as settings for our investigation. Managerial implications are then offered to marketing managers involved in innovation and NPD before the paper is concluded.

2. Theoretical background

While the significance of networks has been noted in several streams of the marketing literature, further work is necessary to improve the management of these networks so that their potential benefits can be fully realized. Networks offer many advantages, such as, shared R&D risks and costs and access to specialised skills (Barringer & Harrison, 2000). However, many inter-organizational innovation initiatives have failed and networks can even be deemed as a drain of resources (Hedaa, 1999). Therefore, investigating the key drivers for managing innovation networks effectively is important. Meanwhile, an emergent stream in the B2B/industrial marketing literature on network management (NM) could contribute to a better understanding, although it is quickly evolving (Golfetto, Salle, Borghini, & Rinallo, 2007; Moller & Rajala, 2007). Theory development in this stream is being shaped by a major debate on whether networks can, in fact, be managed. Arguments in this debate differ based on researchers' views towards the ontological characteristics of networks and the levels of analysis adopted.

2.1. Ontological characteristics of networks

At the crux of the NM debate is the question, ‘what is a network’ and more specifically ‘what are the boundaries of a network’. Networks can be broadly defined as ‘a set of actors and the relational ties among them’ (Iacobucci, 1996, p. 392). Some researchers hold the opinion that networks are boundaryless and possess no hubs (Ford, Håkansson, Snehota, & Gadde, 2002; Hakansson & Ford, 2002). Other researchers, including those in strategic management, argue that sub-networks with definite boundaries can, in fact, be defined (Gulati, Nitin, & Akbar, 2000; Moller, Svahn, Rajala, & Tuominen, 2002; Parolini, 1999). Despite the challenge in defining network boundaries, many organizations have successfully collaborated in networks to achieve their R&D and innovation objectives. From the management viewpoint, it may be necessary to focus on certain meaningful parts of the network (Ojasalo, 2004). These subsets of the larger network, also termed ‘strategic nets’, ‘value nets’ or simply ‘nets’, have been defined around interrelated groups of actors pursuing shared goals (Heikkinen, Mainela, Still, & Tahtinen, 2007; Ritter & Gemunden, 2003).

There are varying opinions on the extent to which networks are intentional or emergent, resulting in disagreement on the degree to which NM is possible. Achrol & Kotler (1999) distinguish between the ‘network of organizations’ and ‘network organization’ perspectives. Researchers adopting the ‘network of organizations’ perspective view networks as emergent, and therefore, somewhat unmanageable (Ritter, Wilkinson, & Johnston, 2004), whereas researchers applying the ‘network organization’ stance perceive nets as intentional, and hence, relatively more manageable (Heikkinen, 2007; Parolini, 1999). Nevertheless, such a distinction is not clear cut. Moller and Rajala (2007) from the latter group of researchers, argue that even emergent networks arise due to intentional actions of its participants. Similarly, intentionally created networks, such as, interventions involving national systems of innovation, may be outlived by continuous networks that emerge in the process (Etzkowitz & Leydesdorff, 2000).

Rather than attempting to distinguish between somewhat ambiguous categories of emergent and intentional networks, focusing on continuous networks may offer useful insights into NM. This approach resonates with relationship marketing (RM) scholars whose attention is placed on ongoing, lasting relationships rather than on mere discrete short term transactions (Dwyer, Schurr, & Oh, 1987; Morgan & Hunt, 1994). Similarly, networks can be viewed as endless transitions of continuous interactions between organizations (Etzkowitz & Leydesdorff, 2000; Medlin, 2006) regardless of intentional interventions and emergent periods. Regardless of whether an RM or a network orientation is adopted, many agree that ongoing long term relationships are desirable (Plank & Newell, 2007; Sheth Sharma, 1997). Therefore, in this study we deal with *live* nets, that is, sets of organizations that are actively interrelated, and therefore, operating together continuously, as opposed to being necessarily embedded in formal, temporal structures that may or may not serve their intended purpose.

In defining networks, attempts are also made to establish levels of formality of ties in the network and to classify them. Some argue that different types of formality in networks may require varying management solutions. Moller and Rajala (2007) categorize networks based on their value proposition. They define innovation networks as ‘relatively loose science and technology-based research networks involving universities, research institutions, and research organizations of major corporations...guided by the ethos of scientific discovery’ (Moller & Rajala, 2007, p. 900). Although they highlight the relatively loosely tied nature of these networks, they also acknowledge that networks are dynamic, and that in reality networks may change over time. Furthermore, in some countries, governments may adopt heavy-handed approaches to innovation policy, and introduce very formal interventions requiring strong ties between network organizations (Mani, 2002). Nevertheless, innovation networks are also seen by other authors as relatively loosely tied organizations (Freeman, 1991).

In this study, therefore, innovation networks are defined as a relatively loosely tied group of organizations that may comprise of members from government, university and industry continuously collaborating to achieve common innovation goals.

2.2. Level of analysis

Traditional researchers from the industrial network approach tend to view networks as boundaryless phenomena (Hakansson & Snehota, 1995; Hakansson & Ford, 2002) that cannot be managed. The NM model by Ford et al. (2002) that emerged from this approach adopts the view that although it may be impossible to manage networks, 'managing in' networks may be possible. However, this NM model does not aim to establish causality between its components (Ford et al., 2002). Within the traditional industrial network approach, role theorists have also attempted to apply the concept of roles to understand network dynamics. In this approach, Heikkinen (2007) highlight several roles for managing in nets. While their study does offer insightful suggestions on management roles in nets, similar to its aforementioned counterparts, it has not yet related roles with network outcomes, and thus, it does not provide indications on which roles might be most significant (Heikkinen, 2007).

Contrary to traditional industrial network theorists and the subset of role theorists, other scholars from the strategic/value networks approach attempt to identify specific sub-networks defined around strategic issues termed as issue-based nets or value nets which, they argue, could be managed (Brito, 1999; Moller et al., 2007; Parolini, 1999). They focus on analysis at the net level rather than at an organizational perspective. Models emerging from this approach classify nets based on their value proposition and suggest management strategies for various types of networks (Moller et al., 2007). However, this analysis does have limitations, as strategies recommended have yet to be linked to network outcomes (Moller et al., 2007).

2.3. Network management at the net level of analysis

While both views of the traditional network theorists and the strategic network researchers are useful in enhancing the understanding of networks, we adopt the latter view as we deem it appropriate for this study which is undertaken at the level of analysis of the net (henceforth we use net and network interchangeably). Increasingly, recognition has been made that certain innovation goals could only be accomplished through the cooperation of multiple organizations. Although the industrial network literature provides rich conceptual multi-layered analyses based on different levels of aggregation of units within the network, the net level perspective that links key managerial factors to net level outcomes remains underdeveloped empirically. The literature generally adopts an organizational perspective based on network involvement with little attention being given to the whole network (Provan & Milward, 1995). Measures, constructs and operational definitions given in the literature remain biased towards organizational antecedents and outcomes rather than reflecting adequate network level measurement.

2.4. Congruency among levels of theory, measurement and statistical analysis

Given the novelty of NM empirical studies, it is critical to ensure the alignment between the net level theory and the corresponding levels of measurement and analysis. Extant theory has focused on the organization or dyadic relationships and their respective measurement levels. Generally, even in network studies, the network constitutes the context rather than the unit of analysis of both the research and ensuing theories (Provan & Milward, 1995). In pioneering empirical research on NM and aiming towards net theory development, articulations of the respective levels of theory, measurement and analysis are crucial. This is particularly important for improving the clarity, precision and rigor of the research, and subsequently, for reducing the likelihood of misinterpretation (Klein, Dansereau, & Hall, 1994). The level of theory in this study is the net. The level of measurement describes the actual source of the data, that is, 'the unit to which data are directly attached' (Klein et al., 1994, p. 198). When researching abstract phenomena that lack clear measures, it is sometimes useful to drill down to the sub-unit level of measurement while retaining focus at the higher level of analysis (Yin, 2003, p. 45). The abstract nature of networks may explain the lack of empirical studies and theory development in NM and the bias towards organization-specific or relational studies.

To facilitate testability, key informants within network organizations are used as the level of measurement. These informants are focused on net level issues rather than on intra-organizational issues. Retaining focus on the larger level of analysis while conducting measurement at the sub-unit level is an important device for focusing case study inquiry (Yin, 2003). In this study, the unit of analysis is the net. After multiple informants are surveyed, their aggregation to the net is subsequently carried out, thereby performing analysis at the network level.

In brief, the level of theory and analysis is the net while measurement is carried out by surveying multiple key informants within each network organization while retaining the focus on net issues. Given the abstract nature of networks, this is done to facilitate testability and tangibility. Though different in some respects, the levels of theory, measurement and analysis all return to the network level and congruency can be facilitated as a result.

3. Conceptual model and hypotheses development

Given our focus on the net level of analysis, this study draws upon factors identified on a preliminary basis in the wider network literature for their impact upon the performance of whole networks rather than merely on the organization. The literature has discussed the impact of power distribution on the network (Oliver, 1991; Rowley et al., 2000). Similarly, the importance of relational factors, such as trust, on the whole network has also been identified in the extant literature (Inkpen & Tsang, 2005; Powell, 1990; Rowley et al., 2000). Others factors, such as coordination and cooperation/conflict (i.e. harmony) have also been recognized for their influence on the network (Denize, Miller, & Young, 2005; Inkpen & Tsang, 2005; Moenaert, Caeldries, Lievens, & Wauters, 2000). Fig. 1 is our conceptual model for managing innovation networks at the net level of analysis. This section discusses the conceptual model by explaining the key factors for NM, its antecedents, inter-relationships and outcomes.

3.1. Key factors for NM

The importance of coordination at the network level of analysis has been acknowledged in the literature. Coordination is defined as the

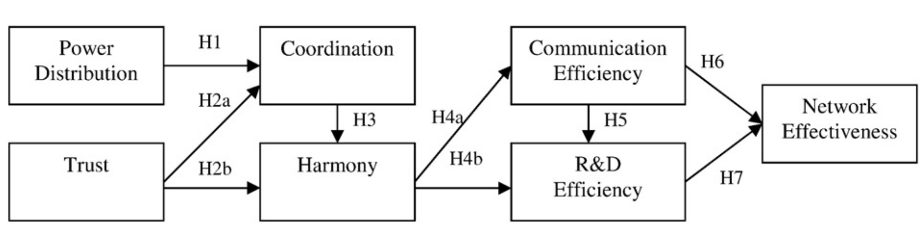

Fig. 1. A conceptual model for managing innovation networks.

extent to which different parties in the relationship work well together in accomplishing a collective set of tasks (Mohr, Robert, & John, 1996; Van de Ven, 1976). The study of coordination has moved from traditional hierarchical management settings (Fayol, 1949) to inter-organizational contexts, such as supply chain management (SCM) (Mohr et al., 1996). Network researchers have suggested that while networks should not be governed by rigid controls, there should be adequate mechanisms to ensure that network outcomes are achieved (Ojasalo, 2004; Powell, 1990; Williamson, 1991). Role theorists also identify important network coordinator roles (Snow & Miles, 1992). However, further research on coordination is needed including its impact on other network factors and outcomes (Heikkinen, 2007; Medlin, 2006).

In addition to coordination, the level of harmony in the network is also important. The term harmony is drawn from the NPD literature. It contains notions of conflict and cooperation that have been highlighted in the network literature. A degree of conflict may be required for innovation while at the same time cooperation may be needed for efficiency (Laine, 2002). Harmony is defined as the development of mutual interests among network actors. It indicates that actors are involved from the early phases of the innovation process, attempt to understand each other's perspectives, resolve their conflicts at the lowest possible level and debate issues rather than simply accept them (Gupta, Raj, & Wilemon, 1986). However, harmony has been traditionally studied in an intra-organizational context while conflict and cooperation have been mainly investigated from a dyadic perspective (Welch & Wilkinson, 2005). Therefore, a network approach is required to investigate the role of harmony in NM.

Network efficiencies include communication and R&D efficiencies. Moenaert et al. (2000) define communication efficiency as communication effectiveness given communication costs with the former including transparency, credibility and knowledge codification and the latter focused on costs, such as secrecy issues. They argue that for effectiveness to be achieved there must be motivation to share information. The transferor must be able and willing to transfer information (Jung, 1980) that must have an impact on the recipient. R&D efficiency is the relative R&D outputs compared to R&D inputs (Fritsch, 2004). In the network context, it is relevant as actors contribute inputs to the innovation process, including funding, infrastructure, skills or other resources and seek to obtain outputs, such as, new knowledge and applications.

3.2. Antecedents to coordination, harmony, communication and R&D efficiency

Power distribution may influence coordination and can be defined as the balance of influence and control in the network. Although the study of power in marketing channels has had a long history, going back to the 1960s, the corresponding theoretical and empirical research has been predominantly dyadic rather than network-based (Wilkinson, Ritter, & Johnston, 2004). Power is usually defined as the ability of one actor to control another and it stems from dependence in the dyad (Frazier & Rody, 1991; Gaski, 1984; Hunt & John, 1974; Welch & Wilkinson, 2005). More recently, the need to explore the impact of power distribution at the network level rather than at the dyadic level has been recognized (Medlin, 2006; Welch & Wilkinson, 2005). The network literature indicates that power distribution in a network may be important for its effective management and in particular its coordination (Hagedoon & Schakenraad, 1992; Zolkiewski, 2001). Therefore, we hypothesize the following:

Hypothesis 1. Power distribution positively influences coordination.

Similar to power distribution, trust is another factor which we identified as an important antecedent to network processes. Trust may be defined as 'confidence in an exchange partner's reliability and integrity' (Morgan & Hunt, 1994, p 23). Although trust has long been recognized for its importance in relationship success (Seppanen, Blomqvist, & Sundqvist, 2007), analysis at the network level remains limited. Extant studies focus predominantly on organizational and even individual levels of analysis (Anderson & Kumar, 2006; Doney & Cannon, 1997; Ganesan, 1994; Nooteboom, Berger, & Noorderhaven, 1997; Smith & Barclay, 1997) or at best the dyad, e.g. universities and businesses (Plewa, 2005). Despite the limited empirical studies of trust at the network level of analysis, network theorists have conjectured the importance of trust to network success (Cravens, Shipp, & Cravens, 1994). Several authors argue that trust influences network coordination as it is seen as a network governance mechanism where networks with higher trust levels require less coordination and involve reduced governance costs (Powell, 1990; Rowley et al., 2000; Seppanen et al., 2007). Others suggest that trust impacts on harmony as it facilitates conflict management given that trusting network actors may forego short-sighted goals, voice their views openly and focus on developing shared initiatives (Achrol & Kotler, 1999; Powell, 1990; Rowley et al., 2000; Seppanen et al., 2007; Uzzi, 1996). Nevertheless, further research is necessary to provide empirical evidence of the impact of trust on both coordination and harmony at a network level of analysis. Therefore, we propose the following two hypotheses:

Hypothesis 2a. Trust positively influences coordination.

Hypothesis 2b. Trust positively influences harmony.

3.3. Interrelationships among coordination, harmony, communication and R&D efficiency

Coordination in the network may impact upon its harmony. Coordination is necessary to ensure that multiple actors can work cohesively (McCosh, Smart, Barrar, & Lloyd, 1998). Coordination may involve a level of formalization, clear definition of deliverables and a single authority who serves as a network manager. Together, these may reduce the likelihood of escalation of conflict to unmanageable levels. Thus, harmony may be maintained. Therefore we hypothesize the following:

Hypothesis 3. Coordination positively influences harmony.

In turn, the degree of harmony may impact on communication efficiency. Harmony involves give-and-take in the relationships with both parties trying to understand the others' viewpoints and incorporate them in early stages when setting innovation agendas. Therefore, it is likely that harmony may increase communication efficiency in the network. Song and Thieme (2006) establish a link between harmony and the information gap as the latter can be a symptom of lack of communication efficiency. The information gap is the difference between ideal and achieved levels of information sharing among participants (Song & Thieme, 2006). This is part of the communication efficiency notion by Moenaert et al. (2000) that includes motivation, willingness and ability to share information. Information exchange is an aspect of communication (Denize et al., 2005). Thus, we propose the following hypothesis:

Hypothesis 4a. Harmony positively influences communication efficiency.

Similarly, harmony may impact on R&D efficiency in networks. Role theorists have suggested that certain roles which are instrumental in maintaining harmony are crucial. These include the roles of compromiser and disturbance handler (Minzberg, 1980). Following calls by

Heikkinen (2007) to link network roles to outcomes, we hypothesize as follows:

Hypothesis 4b. Harmony positively influences R&D efficiency.

3.4. Network outcomes

Network effectiveness can be defined as the degree to which network collaborations are successful and it constitutes the most important network outcome. As network participants are diverse and have different organizational agenda, success should be based on perceptions of effectiveness from each organization within the network. This relative evaluation based on perception is consistent with the relationship marketing literature which contains evaluation of outcomes such as satisfaction based on the perceptions of players in dyads (Plewa, 2005).

While extant literature contains conceptual analyses of network effectiveness from multidimensional levels, measures of network level effectiveness remain underdeveloped (Sydow & Windeler, 1998). Industrial network researchers have attempted to analyze network outcomes from the point of view of the organization, relationship and network as in Ford and Johnsen (2001). However, a measure for evaluating the effectiveness of the network that reflects the diversity of perspectives and goals of the different actors involved is lacking (Provan & Milward, 1995). Therefore, a measure of network effectiveness that captures the diverse views based on perception is deemed necessary Sydow & Windeler, 1998).

Further investigation of network effectiveness and its drivers is necessary. Although the Actor–Resource–Activity model discusses communication efficiency for its impact on network effectiveness, empirical validation of this relationship is lacking (Gadde & Hakansson, 2001). Similarly, further work is necessary to test the relationship between communication efficiency and R&D efficiency as only limited dimensions of this relationship have been tested in the past (Cummings & Teng, 2003). R&D efficiency includes dimensions of cost, time and quality (Kafouros, 2006). The relationship between R&D efficiency and overall network effectiveness should also be investigated as efficiency is seen as a necessary condition, and effectiveness as the final network outcome (Borgström, 2005). Ignoring network effectiveness in achieving objectives of innovation initiatives and simply focusing on efficiency would, thus, be inappropriate. Therefore, we propose the following three hypotheses:

Hypothesis 5. Communication efficiency positively influences R&D efficiency.

Hypothesis 6. Communication efficiency positively influences network effectiveness.

Hypothesis 7. R&D efficiency positively influences network effectiveness.

4. Methodology

While this study employs embedded case studies incorporating qualitative followed by quantitative research, this paper focuses on the quantitative stage.

Fig. 2 illustrates the research design used in this study. Two high-level cases/industries were selected in the Australian setting, ICT and biotechnology/nanotechnology, as innovation networks are prevalent in these industries. Also, they are enabling technologies and permeate a range of related industries, thereby having sufficient size to facilitate further quantitative analysis and increase generalizability. In contrast to holistic cases, embedded case studies have sub-units of analysis (Yin, 2003). Consequently, embedded case studies were adopted in this study as the participating organizations were the sampling units thereby facilitating data measurement. ICT and biotechnology/nanotechnology are dissimilar industries and they were deliberately selected to facilitate the identification of patterns and trends. If trends emerge, it may be possible to generalize results beyond the two industries under analysis. Differences may offer industry-specific insights.

The embedded case study was also deemed appropriate as it offers a coordinated approach that could incorporate both qualitative and

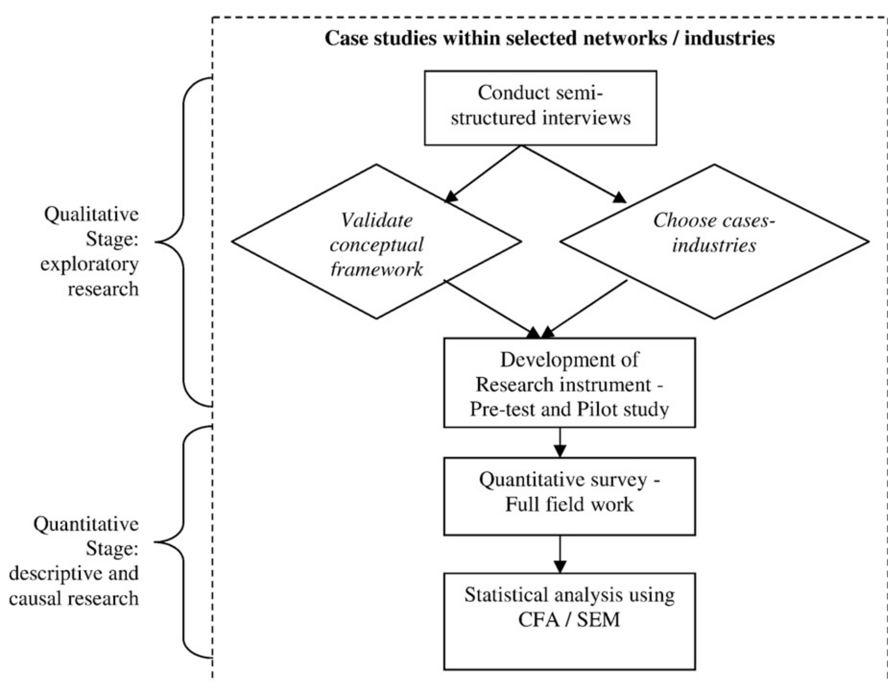

Fig. 2. Flowchart illustrating research design.

quantitative research (Yin, 2003). Qualitative research was necessary to validate the conceptual model, to select industries and also to develop the research instrument, a questionnaire, by ensuring that the proposed constructs are applicable at the network level of analysis. Quantitative research including a pre-test and pilot study was essential in developing the questionnaire (Churchill, 1979). Extensive details of these phases can be found in Rampersad, Quester and Troshani (2009) and Rampersad, Quester and Troshani (2009). The pre-test comprised 16 interviews across several industries, including automotive, ICT, biotechnology and wine, to improve sequencing, flow, and wording and reduce possible ambiguities in the questionnaire. The pilot study focused on a specific network in the wine industry comprising 52 responses from members of university, business and government. Running the pilot in a specific network was essential for increasing the precision of findings, purifying measures via reliability testing, and ensuring that a common frame of reference existed among respondents (Farrelly & Quester, 2003). Confirmatory factor analysis (CFA) via structural equation modelling (SEM) was then crucial, due to the sparse quantitative empirical evidence available at the net level.

In the quantitative stage, respondents were identified using snowballing and through the analysis of secondary data. The interviewees of the qualitative research suggested a group of initial possible respondents. These referrals were also triangulated with information on collaborations from annual reports, public documents, respondents' co-authors from collaborating organizations found in publication lists, and collaboration reports from various organizations in the selected networks.

The questionnaire was divided into 3 sections. The first section contained a net diagram and asked respondents to focus on net level issues, such as, power distribution, coordination and communication efficiency in the net. The second section requested that respondents focus on a particular relationship and that they provide an assessment of trust. In this way, net level trust was derived based on dyadic relationships within the specific net. This was justifiable as the survey instrument was finetuned based on feedback from the pilot phase whereby respondents found that reporting on four relationships resulted in an overly lengthy questionnaire and only reported on one relationship. Additionally, given the connectedness of the network, the snowballing technique used, and that respondents pertained to the same network, reporting on one relationship was deemed sufficient for each respondent. Consequently, an assessment of multiple relationships was obtained from within the same network, and therefore, this approach is deemed acceptable. In the third section, respondents were asked to make referrals up to 5 contacts within their network. As an incentive for providing referrals, respondents were placed in a draw to receive one year subscription for a topical magazine on innovation management. Given the connected nature of networks, snowballing and triangulation with secondary data were deemed suitable methods for defining the boundaries of the population more specifically (Brito, 1999; Iacobucci, 1996; Sarantakos, 1998).

A total of 543 and 411 potential respondents in the ICT and biotechnology/nanotechnology networks, respectively, were sent emails with a request to participate in an online survey during the period September to December 2007. Reminder emails were sent after two weeks of the first. As illustrated in Table 1, 124 and 95 responses were obtained from the biotechnology/nanotechnology, and ICT networks, respectively, representing acceptable response rates (>20%). Since the population was not absolute but based on a consensus view among respondents via snowballing, evaluating non-response bias was not essential. Given that the survey was conducted on a continuous basis by way of referrals to new potential respondents rather than in specific waves, it was not deemed appropriate to assess non-response bias by comparing waves of early and late respondents via tests, such as, the Levene's Test for Equality of Variances (Armstrong & Overton, 1977). The higher number of responses from universities and research organizations compared to business and government was acceptable as this reflects the nature and composition of ICT and biotechnology/nanotechnology innovation networks given their focus on research and scientific discovery.

Table 1
Characteristics of respondents.

Characteristics		Descriptive statistics	
		Biotechnology/ nanotechnology	ICT
Number of respondents (N)		124	95
Network size (number of organizations)		40	34
Duration of relationships	0–2 years (N/%)	11 (10%)	8 (9%)
	2–4 years (N/%)	52 (46%)	40 (46%)
	4–6 years (N/%)	30 (26%)	22 (26%)
	6+ years (N/%)	21 (18%)	16 (19%)
Composition of respondents	Business (N/%)	15 (11%)	23 (22%)
	Government (N/%)	25 (18%)	16 (15%)
	University (N/%)	70 (50%)	39 (38%)
	Research organization (N/%)	30 (21%)	26 (25%)

4.1. Scale development

Some measures used in this study were adapted from the existing literature while extensive scale development was necessary for others (Rampersad et al., 2009). Existing measures for trust were used as they were previously applied in the context of university–industry relationships in Plewa (2005), based on items for trust from Doney and Cannon (1997) and Morgan and Hunt (1994). Therefore, they only required slight adjustments that were based on the results of in-depth interviews and the pre-test to improve their relevance to the wider variety of network participants, including businesses, government, universities and research organizations. Extensive scale development was carried out for all the other constructs as existing scales were used primarily from an organizational perspective. Therefore, these constructs required different sets of items applicable to the network level of analysis. A list of items were pooled from the literature for power distribution to incorporate measures of group centrality, i.e. a structural measure of network power distribution from social network analysis, and others that emerged from interviews and the literature to reflect balance of power in the network (Freeman, 1979; Zolkiewski, 2001). Similarly, items for harmony that reflect mutual interests were sourced from Gupta et al. (1986) and Song and Thieme (2006), and those for coordination incorporating moderate, yet, adequate control and the need for a coordinating body from Mohr et al. (1996), Ojasalo (2004), Stremersch, Wuyts, and Frambach (2001), and Van de Ven and Walker (1984). Items for communication efficiency covered dimensions for transparency, credibility, codification and costs (Moenaert et al., 2000). Measures for R&D efficiency incorporated assessments of R&D inputs and outputs (Fritsch, 2004) and covered the dimensions that stemmed from the literature of cost, time and quality (Kafouros, 2006).

Following Churchill (1979), proceeding the sourcing of items, a pilot study in the wine industry was used to purify the scales using exploratory factor analysis and reliability testing. All items were placed on 7-point Likert scales ranging from 1 — strongly disagree to 7 — strongly agree. Unlike the others, the scale for network effectiveness was placed on a Juster scale ranking 0%–100% that allows respondents to rate their perceptions of network effectiveness. This was deemed appropriate given the variety of network participants and their consequent multiplicity of views in assessing outcomes (Plewa, 2005). Although a simple one-item scale, it is powerful in capturing the variety in criteria used by diverse network participants. The list of the scales used in the pilot study, and subsequently, employed in the ICT and biotechnology/nanotechnology networks can be found in Appendix A.

5. Results

Prior to testing our hypotheses using CFA with SEM, several steps were taken. First multivariate normality was assessed as it is essential for stable application of SEM. Using tests for kurtosis in AMOS, multivariate normality for both the ICT and biotechnology/nanotechnology industry samples were 6.182 and 5.659, respectively, which were less than the upper limit of 7, thus, exhibiting acceptable normality (West, Finch, & Curran, 1995). Second, an assessment of validity and reliability was carried out for all measures. Third, one factor congeneric models for each construct were tested for fit. Forth, the structural model was developed using single indicator latent variables and then assessment of overall fit was carried out. Once fit was established, hypotheses testing followed.

5.1. Validity of measures

Reliability was assessed using coefficient alpha and construct reliability. Coefficient alpha was calculated using SPSS 15.0. Coefficient alpha for all constructs exceeds 0.7, thereby demonstrating acceptable reliabilities (Kline, 2005). Construct reliabilities were calculated using AMOS 6.0. Congeneric models for each separate construct were developed and these provided information on standardized item loadings and error measurement (ε_j) that were essential in the calculation of construct reliability (Byrne, 2001; Kline, 2005). As shown in Appendix A, all constructs achieved acceptable construct reliability exceeding the minimum level of 0.7 (Hair et al., 2006).

Convergent validity was demonstrated by one factor congeneric models whereby item loadings were acceptable as they all exceeded the threshold of 0.5 (Steenkamp & van Trijp, 1991). Evidence of convergent validity was provided for all constructs as variance extracted either equates or exceeds the lower limit of 0.5 (Fornell & Larcker, 1981) (see Appendix A for details). All factors exhibited discriminant validity as their variances extracted, all over 0.500, exceed the square of the highest shared variance between factors which was 0.460 (Fornell & Larcker, 1981) as shown in Appendix A.

5.2. Congeneric models for each construct

We ran one factor congeneric models prior to analysing the full structural model in order to evaluate model fit for each construct. Checking for model fit at the construct level prior to combining them structurally is important for diagnosing and reducing an amalgamation of problems at that later stage. The model fit for all constructs was acceptable (See Appendix A).

5.3. The structural model

After all one factor congeneric models were assessed, a full structural model was developed using single indicator latent variables. These variables were used as a means of data reduction given our small sample size (Rowe, 2002). Furthermore, they were useful as they account for measurement error in the model, and therefore, estimates were less biased compared to the use of composite variables which ignore measurement error (Bollen, 1989). Following Munck (1979), values for the regression coefficient and measurement error were calculated taking into account coefficient alpha (α) and the standard deviation (SD) of the composites using the following formulae:

$$\text{Regression coefficient} = \text{SD}\sqrt{\alpha}$$
$$\text{Measurement error variance} = \text{SD}^2(1-\alpha)$$

Appendix B contains a correlation matrix and shows that the multicollinearity does not pose a problem as no correlations exceeded the upper limit of 0.9 (Hair et al., 2006). Table 2 shows that the fit achieved for the causal model for each industry was acceptable.

5.4. Hypotheses testing

Given that the model exhibited good fit, tests of hypotheses emerging from the literature review were now deemed possible. As demonstrated in Table 3, all hypotheses were supported in at least one industry. Moreover, patterns emerged as six out the nine hypotheses were supported in both industries.

In order to probe more deeply into the type of causal relationships, we checked for mediation and partial mediation using alternative SEM models (Cunningham, 2008). Consistent with results in Table 3, all respective variables demonstrated full mediation. For example, coordination mediated the relationship between power distribution and harmony in both industries. Additionally, harmony mediated the relationships between coordination and communication efficiency and also between the latter and R&D efficiency. In the ICT industry, communication efficiency mediated the relationship between harmony and R&D efficiency, while R&D efficiency mediated the relationship between communication efficiency and network effectiveness. Alternatively, in the biotechnology/nanotechnology industry, R&D efficiency mediated the relationship between harmony and network effectiveness, and communication efficiency mediated the relationship between harmony and network effectiveness. No evidence was provided for partial mediation.

Fig. 3 provides a comparison of significant paths to network effectiveness in the selected industries. Our results reveal a number of similarities and minor differences across industries on the key factors and their relationships required for managing networks effectively. While the relationships pertaining to network outcome

Table 2
Fit indices used to evaluate fit of structural model.

Type of index	Name of index	Acceptable level	B/N	ICT
Model fit	Chi-square		16.116	20.576
	Degrees of freedom (*d.f.*)		12	13
	P Value Bollen–Stine *P* value	>0.05	.29	.186
	Bollen–Stine *P* value	>0.05	.186	.082
Absolute fit	Normed Chi-square (Chi-square/*d.f.*)	<2	1.343	1.583
	Goodness-of-fit (GFI)	>.95	.965	.937
	Adjusted goodness of fit (AGFI)	GFI–AGFI<.6	.919	.865
	Standardized root mean-square residuals (SRMR)	<.05	.0221	.0415
	Root-mean-square error of approximation (RMSEA)	<.08	.053	.079
Incremental fit	Comparative fit index (CFI)	>.95	.993	.981
	Tucker–Lewis Index (TLI)	>.95	.988	.969

Table 3
Hypotheses tests.

Hypothesis	Independent variable	Dependent variable	B/N support/P value			ICT support/P value		
			Estimate	C.r.	*P* val.	Estimate	c.r.	P val.
H1	Power	Coordination	−.402	−3.355	.000	−.472	−3.657	.000
H2a	Trust	Coordination	.421	3.784	.000	.339	2.861	.004
H2b	Trust	Harmony	.425	4.994	.000	.506	5.820	.000
H3	Coordination	Harmony	.628	6.433	.000	.616	6.162	.000
H4a	Harmony	R&D Efficiency	.870	12.064	.000	–	–	–
H4b	Harmony	Com Eff	.899	11.884	.000	.904	9.498	.000
H5	Comm Eff	R&D Eff	–	–	–	.878	10.216	.000
H6	Comm Eff	Net Eff	.394	4.564	.000	–	–	–
H7	R&D Eff	Net Eff	.557	6.020	.000	.902	15.675	.000

Results are based on a 99.9% confidence level.

factors were slightly different, all factors were deemed important in both industries as hypotheses around them were supported as Fig. 3 shows.

A number of patterns were uncovered. Evidence was found supporting the significant impact of power distribution, trust, coordination and harmony on achieving network outcomes in both industries. While both communication and R&D efficiencies are important in achieving network effectiveness, the specific relationships among these factors vary between industries. Given the identification of patterns, the study is indeed important in contributing to theory development in network management at the net level.

6. Discussion

Our study contributes to several streams of marketing including NPD (Rindfleisch & Moorman, 2003; Sivadas & Dwyer, 2000; Wuyts et al., 2004), open innovation (Chesborough, 2003; Laursen & Salter, 2006) and B2B/industrial networks (Ford et al., 2002; Moller et al., 2007). Unlike existing work that either predominantly stresses the importance of networks or provides an organizational perspective based on network involvement, this study informs understanding concerning the management of innovation networks. Specifically, it contributes to these literatures by providing a network level perspective that incorporates the views of various network participants rather than remaining limited to firm or dyadic perspectives that are predominant in the network and relationship literatures, respectively.

We presented a causal model consisting of factors that are needed for managing a type of strategic network, namely, innovation networks. Since our review of extant literature reveals that NM is under-explored at the net level, the significant results of our study provide support for the applicability of new constructs from this perspective, including harmony and coordination. The similarities in patterns on significant factors for managing networks in different industries strengthen the theoretical contribution of this study towards NM at the net level. The dissimilarities that arose are also interesting and there may be possible explanations. For instance, it was not completely surprising that the link between harmony and R&D efficiency was not supported in the Australian ICT industry which features a high degree of outsourcing and adoption of foreign technology rather than local R&D. This may, consequently, increase the relative significance of communication efficiency given the technology transfer processes involved. However, replication of this study in other countries that are relatively more experienced technology innovators may provide evidence supporting the relationship between harmony and R&D efficiency. Another interesting finding was the mediated relationship between coordination and communication efficiency. The evidence found indicates that harmony mediates this relationship and no support is offered for the direct relationship between coordination and communication efficiency. This is surprising as the literature suggests a direct relationship between these constructs although supporting empirical evidence has yet to be provided (Rowley et al., 2000).

The study also makes a methodological contribution for conducting quantitative empirical research at the net level of analysis. Due to the boundary problem, previous empirical studies have defined network boundaries in an ego-centric manner, that is, from the viewpoint of one particular organization while ignoring the perspectives held by other network participants (Provan & Milward, 1995). Others, have only considered mainly the views of one type of participant in the network, such as, university or business actors rather than their combined perspectives (Plewa, 2005). Combined qualitative and quantitative methods, consensus among key informants, snowballing and triangulation with secondary data sources were useful in defining the boundaries

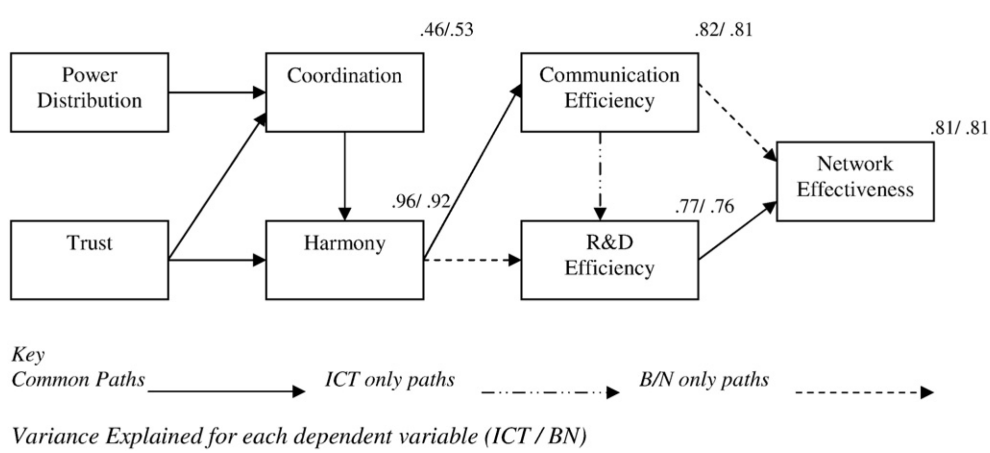

Fig. 3. Comparison of significant paths to network effectiveness.

of the net and in identifying respondents. The network diagrams used during data collection contributed to the improved reliability of the research. As detailed in Appendix A, all constructs demonstrated acceptable reliability as indicated by their respective coefficient alpha and construct reliability values. Therefore, this evidence suggests that our novel methodology, though preliminary, offers much potential when conducting net level research.

7. Managerial implications

The study offers useful managerial implications as detailed in Table 4. These may be of interest to marketing managers involved in NPD and innovation involving multi-sectoral initiatives, such as joint university research, technology parks, innovation clusters and public–private sector research.

As the study revealed that power distribution is important, players should facilitate a balanced atmosphere by refraining from abuses of power or uses of intimidation strategies which may undermine network relationships. In cases where an organization is the coordinating body, it should apply moderate, but not rigid, coordination to ensure understanding and harness the input of all collaborators to facilitate synchronization. To foster a harmonious environment, business participants should appreciate the necessity of being actively involved and of becoming engaged with their research partners in networks from the beginning. This would allow them not only to be able to initiate projects, and become proactive since early phases when research agenda are set, but also to easily assimilate ensuing network outcomes. Adequate negotiation training may also be useful or even fundamental for all network participants for ensuring that healthy give-and-take practices are used among them, that opinions are well articulated and that promised outcomes are achieved. Trust is a critical element in network success, and therefore, participants should engage in trustworthy practices, such as, keeping promises, exhibiting frankness and candor and demonstrating integrity. Communication efficiency could be encouraged by addressing transparency via the public availability of information without compromising patents; credibility via formalized channels in accessible language; and secrecy by taking adequate steps for managing intellectual property. To promote R&D efficiency, collaborators should be selected based on their value contribution rather than their political affiliation.

8. Directions for future research

Interpretation of the results of the study should be undertaken in light of a number of limitations. First, sample sizes of 124 and 95 in the Australian biotechnology/nanotechnology and ICT industries, respectively, although sufficient for accomplishing the aim of our study, are relatively small, and thus, larger samples may be useful to strengthen results. More research is necessary for improving the rigor and reliability of empirical network research (Marsden, 1990). While this research pioneers a viable methodology to capture net level evidence, future research designs should distinguish and analyze the reliability of responses within organizations and among different types of organizations, such as, universities, businesses and government agencies. Sub-group analysis based on the duration of relationships may also be insightful. The small sample size in this study does not facilitate this type of sub-group analysis, but future research in these areas would be useful and offer interesting cross-group comparisons.

Second, testing of the proposed constructs and hypotheses in non-university–business–government networks may also be insightful. Third, the prominence of innovation networks internationally and the need to improve scarce public sector allocations of multi-sectoral research (Provan & Milward, 1995) justify research at an international scale. Furthermore, as innovation infrastructures and their level of development vary across countries, country-specific research is also required to test the applicability of the findings of this study. Fourth, while a cross-sectional approach was suitable given our view of networks as continuous, other researchers may hold different perspectives of networks and may favour a longitudinal approach to uncover additional insights. Finally, one of the major advantages of network research is the ability to incorporate various levels of analysis including the organizational, relationship and network levels. This research contributes to the network level of analysis which was previously underdeveloped. However, following previous multi-level studies (Ford et al., 2002), future research could combine various levels of analysis and their inter-relationships to provide empirical evidence on success factors for managing inter-organizational innovation. Nevertheless, this study provides exploratory evidence about the key factors for managing innovation networks by incorporating the perspectives of the various actors involved.

Table 4
Summary of managerial implications.

Key factors	Managerial implications
Foster respect among players and avoid abuses of power	▪ Players should foster a more balanced power distribution whereby they respect others as they all contribute value to joint network initiatives. ▪ Players should refrain from abusing power and using intimidation strategies which may affect underlying relationships.
Implement appropriate levels of coordination	▪ Although rigid coordination hinders creativity, a moderate degree is required to ensure that the goals are achieved. ▪ A single coordinating body is necessary to ensure continuity and the achievement of network objectives. ▪ The coordinating body should have an understanding of and/or representation of all major collaborators and should adopt a synchronizing, enabling role rather than one of rigid control and bureaucracy.
Encourage harmonious practices	▪ Industry participants should be included in early phases of innovation network projects when setting the research agenda rather than be purely driven by academia. This will ensure that standardized outcomes can be assimilated into industry. ▪ During negotiations, meetings or discussions, there should be give-and-take among network participants. ▪ Each participant in the network should question the other participants if necessary and try to understand their points of view.
Foster an environment of trust in the networks	▪ Trust is a critical element in network success. ▪ To develop trust, it is important that players keep promises, exhibit frankness and candor and demonstrate integrity in their dealings.
Improve communication efficiency	▪ It is important to address issues of transparency, credibility, knowledge codification, secrecy and communication costs. ▪ To improve transparency, information should be made available to current or potential network collaborators in such a way that patents are not compromised. This information could be provided through relevant modes depending on each case, such as, a website, information day or via written documentation. ▪ These formalized avenues may contribute towards knowledge credibility. Information provided should also be presented in simple language so that it can be assimilated by all network collaborators. ▪ To reduce secrecy issues, where appropriate, it is also desirable to have a system for managing intellectual property.
Ensure R&D efficiency	▪ Value contribution of each partner should be stressed.

Appendix A. Scales

	Loadings	
	Biotechnology/nanotechnology	Info. & Com. Technology
	(BN)	(I)
Trust		
This partner kept promises it made to our organization.	.90	.82
We believed the information that this partner provided us.	.72	.74
We trusted this partner to keep our best interests in mind.	.71	.86
We felt that this partner was on our side.	.80	.87
This partner was frank in dealing with us.	.86	.91
This partner could be counted on to do what is right.	.94	.92
In our relationship, this partner had high integrity.	.96	.90
Chi-square = 16.909 (BN) 20.782 (I), *d.f.* = 14(BN) 14(I), *P* value = 261(BN).107(I)		
GFI = .962(BN).944(I), CFI = .996(BN).990(I), α = .944(BN).953(I)		
Construct reliability = .874(BN).874(I), Convergent validity = .501(BN).500(I)		
Mean = 5.08(BN) 4.9885(I), standard deviation 1.37(BN) 1.38(I).		
Power		
One or more large participants dominated the network. (rvd)	.59	.76
The power distribution in the network was even.	.81	.88
My organization had the same amount of power as the other participants' organizations.	.73	.74
Chi-square = .743 (BN) 2.509 (I), *d.f.* = 8(BN) 8(I), *P* value = 0.491(BN).961(I)		
GFI = .98(BN).991(I), CFI = 1.000(BN) 1.000(I), α = .746(BN).832(I)		
Construct reliability = .747(BN).750(I), convergent validity = .500(BN).501(I)		
Mean = 4.16(BN) 4.16(I), standard deviation 1.34 (BN) 1.40(I).		
Coordination		
Degree of formalization		
Our organization's programs were well-coordinated with the network's programs.	.89	.90
Our activities with this network were well-coordinated.	.84	.83
α = .854(BN).857(I)		
Inadequate coordination		
We felt like we never knew what we are supposed to be doing for the collaboration. (rvd)	.80	.94
We felt like we never knew when we were supposed to be contributing to the collaboration. (rvd)	.82	.91
α = .791(BN).919(I)		
Role of network manager		
There was an individual, group or organization (either existing or new) that took responsibility for the collaboration and expected to take care of coordinating activities in the network and also exercising authority on behalf of the network if necessary.	.61	.79
A coordinating body was designated or identified that includes input from all collaborators.	.72	.68
α = .603(BN).692(I)		
Chi-square = 6.653 (BN) 8.078 (I), *d.f.* = 6(BN) 6(I), *P* value = .354(BN).232(I)		
GFI = .983(BN).973(1), CFI = .997(BN).992(I), α = .732(BN).723(I)		
Construct reliability = .855(BN).856(I), convergent validity = .500(BN).500(I)		
Mean = 4.79(BN) 4.76(I), standard deviation 1.08(BN)1.03(I).		
Harmony		
During negotiation, meetings or discussions, there was give-and-take among participants. Each challenged the others and tried to understand the others' points of view.	.81	.66
The research institution and the industry partner were involved in the early phases of discussion in setting the research agenda.	.58	.61
There was compromise among participants in decision-making and each party obtained value from the network.	.69	.75
Chi-square = 7.709 (BN) 12.849 (I), *d.f.* = 8(BN) 8(I), *P* value = .462(BN).117(I)		
GFI = .980(BN).957(1), CFI = 1.000(BN).971(I), α = .778(BN).718(I)		
Construct reliability = .746(BN).749(I), convergent validity = .500(BN).500(I)		
Mean = 4.89(BN) 4.80(I), standard deviation 1.21(BN)1.03(I).		
Communication efficiency		
Transparency		
Communication in the network was transparent.	.96	.99
Communication in the network was clear and accessible.	.93	.87
α = .943(BN).926(I)		
Codification		
Information that we received via the collaboration lead to a change in attitude.	.83	.78
Information that we received via the collaboration lead to a change in behavior.	.88	1.03
α = .842(BN).894(I)		
Credibility		
The other participants were unable to transmit information that was required through the network. (rvd)	.83	.69
The other participants were unwilling to transmit information that was expected through the network.v (rvd)	.72	.77
α = .742(BN).690(I)		
Costs		
Communication in the network was too costly. (rvd)	.80	.82
There were no secrecy problems in the network.	.73	.70
α = .74(BN).724(I)		

Appendix A (*continued*)

	Loadings	
	Biotechnology/nanotechnology (BN)	Info. & Com. Technology (I)
Communication efficiency		
Costs		
Chi-square = 18.976 (BN) 26.655 (I), *d.f.* = 14(BN) 14(I), *P* value =.166(BN).057(I)		
GFI = .964(BN).937(1), CFI = .990(BN).966(I), α = .834(BN).765(I)		
Construct reliability = .887(BN).887(I), convergent validity = .500(BN).500(I)		
Mean = 4.54(BN) 4.60(I), standard deviation 1.12(BN).92(I).		
R&D efficiency		
The collaboration in the network was productive.	87	.92
The time spent in the collaboration was worthwhile.	.91	.91
We were always delighted with the performance coming out of this network.	.84	.76
Chi-square = .743 (BN) 2.509 (I), *d.f.* = 8(BN) 8(I), *P* value = 0.491(BN).961(I)		
GFI = .98(BN).991(I), CFI = 1.000(BN) 1.000(I), α = .902(BN).895(I)		
Construct reliability = .751(BN).750(I), convergent validity = .502(BN).501(I)		
Mean = 4.84(BN) 4.94(I), standard deviation 1.36(BN) 1.34(I).		
Network effectiveness		
The following question relates to the level of network effectiveness that you perceive. Using the following scale, in your view please indicate the level of effectiveness of this network. Please place an X next to **one percentage** (%) figure. Zero percent (0%) indicates the lowest level of effectiveness and one hundred percent (100%) indicates the highest level of effectiveness.		
□ 0% □ 10% □ 20% □ 30% □ 40% □ 50% □ 60% □ 70% □ 80% □ 90% □ 100%		

Note: rvd = reversed scale.

Appendix B. Correlation matrices

	Effectiveness	Power	R&D eff	Comm Eff	Harmony	Coordination	Trust
ICT industry							
Effectiveness	1.000						
Power	−.354	1.000					
R&D efficiency	.855	−.372	1.000				
Comm Eff	.690	−.389	.725	1.000			
Harmony	.620	−.428	.651	.682	1.000		
Coordination	.536	−.444	.563	.590	.649	1.000	
Trust	.576	−.332	.605	.634	.697	.434	1.000
Biotechnology/Nanotechnology industry							
Effectiveness	1.000						
Power	−.458	1.000					
R&D eff	.821	−.452	1.000				
Comm Eff	.755	−.448	.676	1.000			
Harmony	.736	−.481	.726	.719	1.000		
Coordination	.646	−.469	.637	.632	.678	1.000	
Trust	.675	−.464	.666	.660	.708	.535	1.000

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